Competitive Intelligence Maturity Models: Systematic Review, Unified Model and Implementation Frameworks

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ABSTRACT Competitive Intelligence (CI) is vital for sustaining the performance of organisations in an increasingly volatile, uncertain, complex, and ambiguous (VUCA) world. However, the impact of CI on performance is proportional to its maturity level. The article aims to review and integrate the existing literature on Competitive Intelligence Maturity Models (CIMMs) to provide a go-to framework for setting up, assessing, and developing CI. The CIMMs were sourced from scholarly databases, registers, the social web, and using backwards and forward searches. All the CIMMs respecting the characterisation criteria were included in the study. A scientific and empirically validated definition of CI guided the integration and synthesis of the fourteen selected CIMMs. The primary outcome is a proposed unified CIMM (UCIMM) covering all the CI dimensions and aspects in tandem with the respective implementation guidance frameworks. The proposed UCIMM and implementation frameworks effectuate the guidance needed to set up, assess, and develop the CI practice and theory and, ultimately, the performance of organisations.

1. INTRODUCTION

CI is "the process and forward-looking practices used in producing knowledge on the competitive environment to improve organisational performance" (Madureira et al., 2021a, 2021b). The maturity of the CI practice is positively correlated with being a learning organisation (Senge, 2006). A learning organisation addresses future decision-making proactively, effectively, and efficiently. Within the contingency theory (Fiedler, 1964; Vroom & Yetton, 1973), organisations use decision-making to achieve a strategic fit with their competitive environment (Duncan & Weiss, 1979). The better the decision-making, the greater the fit and the organisational performance (Eisenhardt, 1989). Therefore, CI maturity is both an antecedent and a proxy for organisational performance.

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In the current zeitgeist of a VUCA world with an exponentially increasing speed of change (Bennett & Lemoine, 2014), obtaining and maintaining the strategic fit to sustain top performance is the ultimate challenge. CI is thus vital to navigating highly challenging environments, remaining competitive (Harkleroad, 1998; Hedin, 2005; Vedder & Guynes, 2001), and ensuring the superior performance of organisations (Yap et al., 2018, 2013; Yap & Rashid, 2011). The problem arises in maintaining a CI maturity level that allows organisations to deal with change. Kahaner (1997) has long identified the critical change drivers as the increasing business pace, information overload, more aggressive and global competition, geopolitical changes, and rapid technological change. Nassim Taleb (2007) provided further insight into their volatility and unpredictability. Recent academic and business research corroborates and reinforces the severity of the impact on both organisations and the CI practice (Heppes & Du Toit, 2009; Calof et al., 2017; M-Brain et al., 2019; Klue & SCIP, 2021; ACI & Gilad, 2022; Crayon & SCIP, 2022). As a result, CI evolves up to the average maturity level (Hedin et al., 2014; Heppes & Du Toit, 2009; M-Brain et al., 2019). Organisations must be able to address these impacts in setting up, assessing, adapting, and developing the CI maturity level to obtain top performance. Therefore, the CIMM, consisting of several archetypal levels of achievement across the different dimensions and aspects, is a critical assessment and guidance tool supporting the CI practice evolutionary path.

Previous literature consists of tens of CIMMs. The development approaches for these models range from identifying best practices (APQC et al., 2004; Calof, 1998; J. P. Herring & Leavitt, 2011; Marceau & Sawka, 1999) to assessing cutting-edge CI functions (CIF), programs (CIP), or systems (CIS) (Heppes & Du Toit, 2009). Academic investigations (Calof, 1998; Oubrich et al., 2018), executive opinion (Marceau & Sawka, 1999), practitioners' self-assessments (Comai & Prescott, 2007), and CI experts' professional judgment vendor-sponsored studies (M-Brain et al., 2019) have been the formats of choice in evaluating the professional status and developmental progress of the CI practice. Benchmarking versus an independently established model (Hedin et al., 2014) and case studies are the most frequently used methods (J. P. Herring & Leavitt, 2011). However, CI dimensions and descriptors, as well as the maturity levels used, vary considerably. Most importantly, MMs are not exhaustive regarding the CI dimensions and aspects.

As a result, given the broad range of existing CIMMs, it is incredibly challenging to compare and identify the relevant model to use for improving practice or scientific research. Furthermore, no CIMM fully aligns with the conceptual definition of CI, its longitudinal evolution over time, or its full array of dimensions and aspects. These difficulties profoundly impact the scientific development of the CI practice, especially in smaller and less mature organisations. Thus, researching a unified scientific CIMM (UCIMM) is extremely important for effective practical guidance to address the conflicting interests of academics, executives, practitioners, and vendors.

This study aims to fill this gap by performing a systematic literature review – using an explicit, systematic method for identifying, analysing, integrating, and synthesising the findings of prior research – contributing to the conceptualisation of CIMM research. This conceptualisation will allow for integrating relevant descriptors across all dimensions and levels of maturity into a holistic go-to UCIMM. The expected empirical contributions from such a unified model are the significant improvement of decision-making quality and the consequent business performance, the implementation guidance for the effectuation of the CI practice or function, and the increased productivity of CI professionals. Furthermore, the grounding of this theory development exercise in sound theoretical and empirical evidence will highlight critical gaps and paths to exploit while dismissing outdated, irrelevant and duplicate research (Webster & Watson, 2002). Our systematic review based on scientific, commercial and grey literature is expected to deliver on this objective.

The following section details the systematic literature review procedure according to the PRISMA statement (Page, McKenzie, et al., 2021). Results will then be critically analysed and discussed, and a UCIMM will be proposed in the sections that follow. Finally, we conclude with implications and recommendations for application and further research avenues for this topic and the CI field.

2. LITERATURE REVIEW

To identify and characterise the relevant CIMMs published in the last three decades, we conducted the systematic review as outlined in table 1:

Table 1. Overview of the literature review based on PRISMA, Cooper and Webster & Watson Guidance (Cooper, 1988; Page, Moher, et al., 2021; Webster & Watson, 2002)

Item	Description
Scope	Focus on CIMMs as research outcomes and practices or applications from all types of literature. However, only CIMMs that meet the MM characterisation are within scope (cf. Section 3.2).
Goals	Identify, synthesise, and integrate existing CIMMs into a unified holistic CIMM (UCIMM) to support the development of a common linguistic framework covering all CI dimensions per the 5Ps (Madureira et al., 2021a).
Perspective	Espousal of position in demonstrating the value of integrating existing CIMMs with the 5Ps of CI.
Coverage	Exhaustive as it intends to be "comprehensive in the presentation of works relevant to the topic" (CIMMs).
Organisation	Historical in combination with CIMMs content analysis (Cooper, 1988).
Audience	CI scholars, CI practitioners, CI vendors, business executives, policymakers
Time frame	CIMMs literature published after 1980.
Conceptualisation	CI, MM, CIMM (cf. Section 2).
Search strategy	Combination and proximity of the search terms "maturity model" and "competitive intelligence" to ensure the exhaustiveness as mentioned above.
Sources	Database (DB), registers, CI journals (i.e., CIR and JISIB), and social web as we expect to find CIMMs from practitioner and commercial sources.
Procedure	Data was collected, analysed, synthesised and integrated by a single author to avoid reviewer bias for approximately one year between January and December 2022. DB search: Google Scholar, ScienceDirect (Scopus), AB/Inform (Proquest), JSTOR, Emerald Publishing, EBSCO (Business Source Ultimate). Specific CI Journals: Competitive Intelligence Review. Registry search: SCIP.org (Strategic and Competitive Intelligence Professionals). Social web search: use Google Search to identify leading practitioner and commercial literature [i.e., CI vendors (services and technology/software) CIMMs]. These sources cover journals, books, conference proceedings, and practitioner sources (Brocke et al., 2009). Backwards and forward search: reviewing the citations found in articles from the first step; "to identify articles citing the key articles identified in the previous steps" (Webster & Watson, 2002). All steps: examine at least titles, abstracts, and introductions in order to evaluate only relevant sources (Brocke et al., 2009).
Outcome	The anticipated outcome is an identification of the main CIMMs, their dimensions, and their aspects. We followed the guidance of Cooper (1988) to "combine organisations, […] by addressing works historically within a given conceptual framework." The chosen framework is the 5Ps (dimensions and descriptors) from the CI unified view and modular definition (Madureira et al., 2021a). To the best of our knowledge, still "no classification system for CIMMs exists to date." Therefore, for the content analysis of the MMs, we use a concept-centric approach based on so-called concept matrices (Webster & Watson, 2002).

2.1. Definition of Key Variables and Study Boundaries

2.1.1. Competitive Intelligence

Until recently, the definition of CI was not consensual and changed over time, as the previous five universal definitions demonstrate (Bartes, 2014; Breakspear, 2013; Brody, 2008; Marcial, 2018; Pellissier & Nenzhelele, 2013). However, Madureira et al. (2021a) developed a unified view and modular definition, the only empirically validated one (Madureira et al., 2021b). Furthermore, this definition provides the 5Ps – the core defining dimensions and respective descriptors – which may be used as a proxy for assessing the comprehensiveness of a CIMM. As such, we will use this working definition alongside its visual abstract as the guide for comparing and integrating the different CIMMs analysed in the literature review.

2.1.2. Maturity Models

Maturity is "the state, fact, or period of being mature" (Oxford English Dictionary, 2022a). As such, it implies the existence of an evolutionary process to achieve the desired end-state. A model is a simplified representation of reality used as an example to follow or imitate (Oxford English Dictionary, 2022b). A Maturity Model (MM) details the evolution levels (also known as stages or phases) of maturity across several structuring dimensions and their respective aspects. Levels have differentiating descriptors providing the purpose and detailed characterisation of each level. Dimensions are areas of capability that structure the object of the model. Each dimension is subsequently structured into several aspects (also known as elements, activities, or measures) for each level (Bruin et al., 2005; Fraser et al., 2002). MMs serve as guide rails to the set-up and development path to achieve the targeted maturity level (Fraser et al., 2002). Lahrmann & Marx (2010) characterised MMs as shown in Figure 1.

Criteria	Characteristics		
Dimensions	One-dimensional	Multi-dimensional	Hierarchical
Maturity principle	Continuous	Staged	
Number of audiences	Single	Multiple (configurations)	
Assessment approach	Qualitative	Quantitative	

Figure 1. Fundamental characterisation of MMs (Lahrmann & Marx, 2010, tbl. 1)

In this regard, we will base our study on a few considerations. First, De Bruin et al. (2005) guidance suggests that dimensions should be exhaustive and distinct. Second, MMs have single or multiple dimensions but can also be hierarchical. Hierarchical MMs are more complex and require a formal architecture of measures (Lahrmann & Marx, 2010). Third, staged MM models require compliance with all the dimensions (Fraser et al., 2002), the specified goals and critical practices to reach the aimed level. Fourth, although we acknowledge the different MM audiences, this paper aims to provide industry-agnostic maturity recommendations. Finally, the maturity level assessment can be qualitative using descriptions or quantitative using Likert-like scales (Fraser et al., 2002).

2.1.3. Competitive Intelligence Maturity Model

CI maturity relates to the process of thoroughly developing its practice across all dimensions for each level of the model. This maturity can be computed in levels (staged model) or configurations (continuous model). Considering the previous subsections, the CIMM guides both the effectuation, the maturity assessment, and the improvement of the CI practice. Thus, CI maturity indicates the level of development for each of the 5Ps (dimensions) and respective descriptors for a predefined audience, organisation, industry, or country. Notable, CIMMs allow economic agents to assess, understand, and improve their performance. Finally, given that CI is multidisciplinary, the CIMM is a broader-scoped umbrella maturity model. As such, this study considers only CIMMs, not Business Intelligence, Market Intelligence, Data Management, Social Intelligence, or Capability Maturity Models (CMMs), as those would be specific and not representative of the overall CI concept.

3. The CIMMs STATE OF THE ART

3.1. Literature Search Results

The search focused on six scholarly databases (DB), one register (SCIP.org), one specific journal (Competitive Intelligence Review), the Social Web, and Citation Searching (i.e., snowballing). We screened all the results except for Google Scholar and Google Search, where we stopped at the saturation point, i.e., no more showing of

relevant or duplicate CIMMs. We successfully retrieved all the 38 records sought and screened for relevant CIMMs matching the scope (cf. Table 1) and MM characterisation (cf. Figure 1). Snowballing – backward and forward search – allows us to identify five additional records. Scholarly DBs and registers allowed us to elite eight reports while other methods identified six further. The outcome was fourteen reports included in this study (Figure 2).
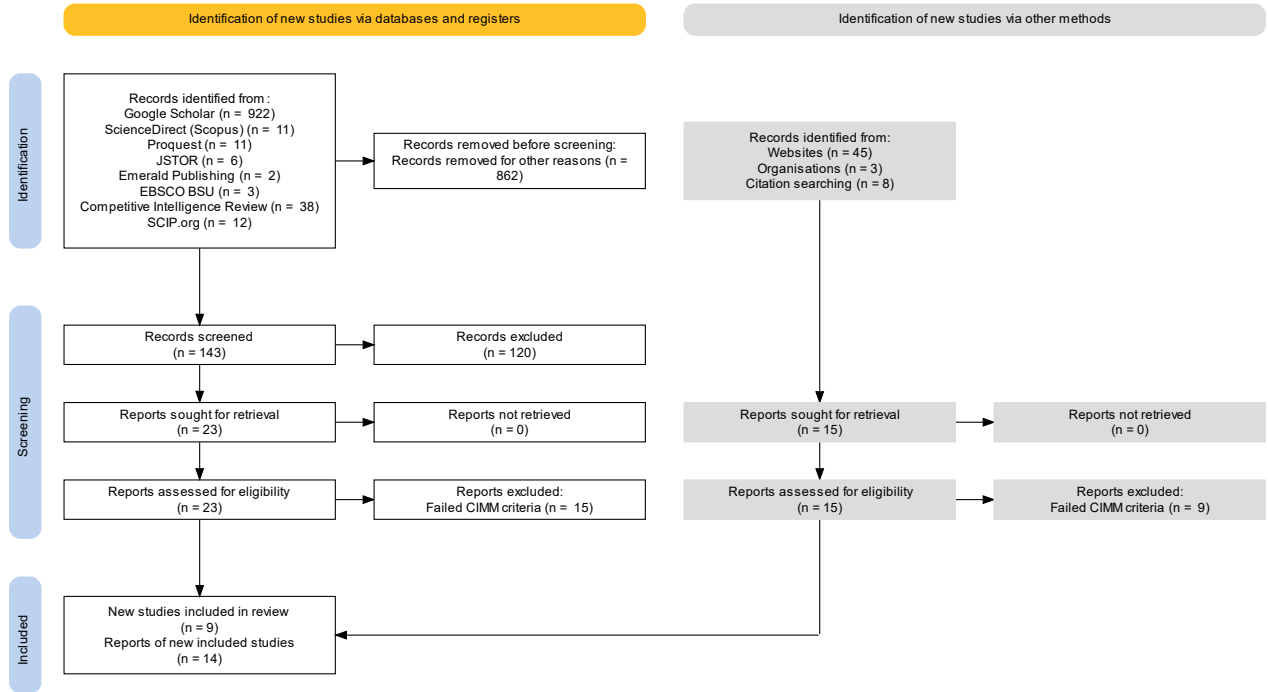

Figure 2. PRISMA 2020 flow diagram used for the systematic review (Page, Moher, et al., 2021)

3.2. Overview of the selected CIMMs

The overview goes beyond the criteria from Section 2-1 by adding supporting scientific or empirical evidence and the motive supporting the development of the CIMM (Table 2). We included a further detailed characterisation in Annex 2. A CIMM is developed every year and a half in the defined 1980-2022 timeframe denoting the longitudinal importance of the topic. The CIMMs have 4,1 levels (computed for staged maturity principle) and 6,4 dimensions on average. They are primarily qualitative, based on case studies or surveys, and focused on assessing and improving the CI function or programmes. Only one CIMM (M-Brain et al., 2019) is motivated by increasing the performance of organisations, which is the ultimate purpose of CI (Madureira et al., 2021a, 2021b).

Table 2. Detailed characterisation of included CIMMs (developed by the authors)

(Authors, Year) Citation	Name of the CIMM	Dimensions	Maturity Principle	Number Of Audiences	Assessment Approach	Study / Report	Motivation
(Calof, 1998)	Competitive Intelligence Quotient (CIQ)	Multi-dimensional: 4	Continuous to Maturity (WCCI)	Multiple	Qualitative	Report	Economic Policy
(Marceau & Sawka, 1999)	World-Class CI Program in Telecoms (WCCIP-T)	Multi-dimensional: 5	Continuous	Single (Telecom)	Qualitative	Study of Telecoms practices	CI Program development framework
(Prescott, 1999)	Action-Oriented CI Program (AOCIP)	Multi-dimensional: 5 + 5	Staged: 4	Multiple: Proposal Management Professionals focus	Qualitative	Report based on APQC 1997 Best Practices study	Improve CI effectiveness

(West, 2001)	CI Stages of Development (CISoD)	Multi-dimensional: 4	Staged: 3	Multiple: European focus	Qualitative	Report	CI usage development
(APQC et al., 2004)	FIICH Model (FIICH)	Multi-dimensional: 5 + 21	Staged: 4	Multiple	Qualitative	Study of CI best practices	Guide CI efforts leveraging empirical best practices
(J. P. Herring & Leavitt, 2011)	CI Maturity Matrix (CIMMx)	Multi-dimensional: 5	Staged: 5	Multiple	Qualitative	Case Study	Implement and develop CI best practices
(Comai & Prescott, 2007)	World Class CI (WCCI)	Hierarchical: 9 + 48	Continuous: 1-5	Multiple	Mixed. Mostly Quantitative	Study	Identify the Dimensions, Level and Drivers for WCCI
(Singh et al., 2008)	Roadmap for Enduring CI Success (RECIS)	Multi-dimensional: 11	Staged: 4	Multiple. Additional focus on Pharma	Qualitative	Study based on Worldwide CI Survey	Ensure CI success
(Heppes & Du Toit, 2009)	CI Function Maturity Level (CIFML)	Multi-dimensional: 8	Staged: 3	Single (Banking)	Qualitative	Case Study	Establish the CIF maturity level within a South African retail bank
(J. P. Herring & Leavitt, 2011)	World-Class CI Program Roadmap (WCCIPR)	Multi-dimensional: 4	Staged: 3	Multiple	Qualitative	Report	Show CIF evolution and promote Organisational Learning
(Hedin et al., 2014)	World Class MI Roadmap (WCMIR)	Multi-dimensional: 6	Staged: 5	Multiple	Mixed. Mostly Quantitative	Report based on own global survey	Guide the development of the CI function
(Oubrich et al., 2018)	Competitive Intelligence Maturity Model (CIMM-M)	Multi-dimensional: 6	Staged: 3	Multiple. Focused on Morocco.	Mixed. Mostly Quantitative	Report based on own local survey	Identify the purpose and propose a CIMM to assess Morocco CI practices
(M-Brain et al., 2019)	M-Brain - World-Class Intelligence Framework (WCIF)	Multi-dimensional: 9	Staged: 5	Multiple	Mixed. Mostly Quantitative	Report based on own global survey	Help organisations improve business performance
(Alvares et al., 2020)	Organisational Intelligence Maturity Model (OIMM)	Hierarchical: 2 + 17	Staged: 6	Multiple	Qualitative	Report	Understand, implement, improve, benchmark or self-assess IM, KM, or CI models.

3.3. CIMMs benchmark vis-à-vis the CI 5Ps and descriptors

We analysed and compared the content of the selected CIMMs vis-a-vis the dimensions (5Ps) and descriptors of the CI unified view and modular definition scientifically validated by Madureira et al. (2021a, 2021b). As such, the visual abstract of the paper (Madureira et al., 2021a) provided a standardised meta-model (Lahrmann & Marx, 2010) for content analysis (conceptualisation, codebook creation, coding, refinement, and reliability check), guaranteeing the scientific rigour of the classification process (Neuendorf, 2019). Furthermore, the Webster & Watson (2002) conceptual-centric approach allows for the comparison between the CIMM's meta-model (dimensions and aspects) and the 5Ps (Purpose, Purview, Practices, Process, and Product) and underlying descriptors – Table 3. In its preparation, we paid particular attention to three potential issues.

First, synonymy – different names for the same dimension/aspect. Second, polysemy – same name but meaning different dimensions/aspects. Last, homonymy – similar names suggesting similar dimension/aspect but effectively meaning different dimensions/aspects. Additionally, we needed to make several assumptions:

- the tools and techniques can refer to the Process or the Product dimensions – e.g., Analysis of Competing Hypothesis (ACH) can either refer to the technique used in the process of analysis or the product of such analysis, the CI deliverable;

- that we correctly empathised with the meaning the author intended to convey from reading the original article;

- that some CIMM dimensions need to be split (hence appearing in two or more columns in table 3 below) for two reasons:

    1) CIMMs included aspects that correspond

to different benchmarked dimensions (Madureira et al., 2021a) – e.g., the "strategic significance" dimension from Comai & Prescott (2007) has aspects of three of the 5Ps, Purpose (usage in strategy development), Purview (focus on the strategic scope), and Practices (CI is included in the corporate strategy statement);

2) they refer to various dimensions or aspects in different maturity levels.

Table 3. Integration and benchmark of included CIMMs vis-à-vis the Unified View and Modular Definition of CI (Madureira et al., 2021a)

(Authors, Year) Citation	Name of the CIMM	CI Dimensions and (aspects)					Model Maturity Levels
		Purpose	**Purview**	**Practices**	**Process**	**Product**	
(Calof, 1998)	Competitive Intelligence Quotient (CIQ)		Activities (scope)	Style Resources	Activities (reporting, sources)	Tools	1. Infancy 2. Maturity/World Class
(Marceau & Sawka, 1999)	World-Class CI Program in Telecoms (WCCIP-T)	Decision-support (opportunities) Culture (early warning)		Process (interface, location) Culture (info sharing)	Process (key activities, interface) Decision-support (options) Technology (storage)	Decision-support (portfolio, tools techniques) Technology (infrastructure)	World Class (continuous)
(Prescott, 1999)	Action-Oriented CI Program (AOCIP)	Focus		Location & structure (personnel) ethics	Location & structure (network) Projects	Products (TAR)	1. Gathering 2. Industry & competitor analysis 3. Strategic decision making 4. Core capability
(West, 2001)	CI Stages of Development (CISoD)	Applications (anticipation)		Organisation Applications (curiosity)	Data Collection	CI Systems	1. Aware 2. Sensitive 3. Intelligent
(APQC et al., 2004)	FIICH Model (FIICH)	Change (performance) Focus (goals & objectives)		Implement Institutionalise Change (behaviour)	Hone Change (process)		1. Prestart-up 2. Start-up 3. Established 4. World Class
(J. P. Herring & Leavitt, 2011)	CI Maturity Matrix (CIMMx)	Processes (aligned)		Teams Tools (Training) Processes (culture, ethics, legal)	Processes (gathering, cyclic) Techniques (KITs, Sources, Analytical)	Products Tools (Techniques, tools)	1. Ad-hoc 2. Emerging 3. Defined 4. Institutional 5. Optimised
(Comai & Prescott, 2007)	World Class CI (WCCI)	Strategic significance CI in SBU (vision)	Project selection Strategic significance	Human resources Evolution Governance Culture Process (protocol) Resources (financial)	Projects Process (sub-processes) CI in SBU (procedure, governance)	CI in SBU (portfolio) Resources (system, software)	1. Not started 2. Some progress 3. Still a lot to do 4. Nearly achieved 5. Fully achieved
(Singh et al., 2008)	Roadmap for Enduring CI Success (RECIS)			People Analysis (capability) Professionalism Organisational structure Roles & responsibilities Awareness Value perception	Processes Research Analysis (insight)	Technology	1. Stick fetching 2. Pilot 3. Proficient 4. World Class

(Authors, Year) Citation	Name of the CIMM	CI Dimensions and (aspects)					Model Maturity Levels
		Purpose	Purview	Practices	Process	Product	
(Heppes & Du Toit, 2009)	CI Function Maturity Level (CIFML)	Relationship w/ management (strategy, early warning, opportunities) Deliverables (strategy)		Relationship w/ management (C-suite) Staffing Skills & training	Relationship w/ management (decision) Capabilities Analytical products Sources of Information Info requirements	Deliverables	1. Early stage 2. Mid-level 3. World Class
(J. P. Herring & Leavitt, 2011)	World-Class CI Program Roadmap (WCCIPR)	Policies (mission, alignment) Uses (strategic planning, strategy, benchmark) Methods (early warning, threats)		Professional development Policies (governance, mission) People Users (training) Methods (future studies) Uses (long-range planning)	Processes (CCI) Procedures (KITs) Methods (sub-processes) Users (networks) Sources	Users & uses (products) Methods (products, expert systems, software) Processes (value added)	1. Developmental 2. Professionalisation 3. Optimisation
(Hedin et al., 2014)	World Class MI Roadmap (WCMIR)	Scope (purpose)	Scope (macro, meso, user groups)	Organisation Culture	Process Tools (templates, techniques)	Deliverables Tools (CI system)	1. Firefighters 2. Beginners 3. Coordinator 4. Directors 5. Futurists
(Oubrich et al., 2018)	Competitive Intelligence Maturity Model (CIMM-M)	Impact	Relationship w/ management (functions)	Resources Structure Strategy & culture	System Analytical Deliverables Capabilities CI Use Relationship w/ management (actionable)		1. Early stage 2. Mid-level 3. World Class
(M-Brain et al., 2019)	M-Brain - World-Class Intelligence Framework (WCIF)	Leadership Scope (strategic objectives, opportunities, early warning)	Scope (external environment)	Organisation Culture Management Scope (forward-looking)	Process Stakeholders Digitalization	Deliverables Tools	1. Informal 2. Basic 3. Intermediate 4. Advanced 5. World Class
(Alvares et al., 2020)	Organisational Intelligence Maturity Model (OIMM)			Org. learning (capability) Org. capabilities Org. memory (capability) Spaces Info. policy Culture Individual Vision Env. scanning (practice)	Env. scanning (process) Storage, search, recovery Sharing & re-usage Usability (use) Org. memory (storage) Security Org learning (process)	Knowledge value Knowledge and info processes Intel. reports Usability (system) Technology	1. Initial 2. Intermediate 3. Advanced
CIMMs w/ dimension	Σ	11	5	14	14	12	**Average Levels:** 3,9
Dimension Alignment	%	78,6%	35,7%	100%	100%	85,7%	**Total Benchmarked Aspects:** 33
Aspects average alignment	%	30,0%	11,9%	42,9%	33,8%	31,3%	
(Madureira et al., 2021a)	Competitive Intelligence Unified and Modular Definition (adapted from Visual Abstract for benchmarking)	Performance Decision (specific goals, competitive advantage, early warning)	Competitive environment External (macro, meso, micro) Internal (org. functions)	Org. practices Capabilities (individual, organisational, structure, policies, mindset, culture) Orientation (time horizon)	Activities Procedure (processes, characteristics)	Knowledge Nature (augmented, machine, human) Outcome (knowledge management, characteristics)	

4. DISCUSSION OF FINDINGS

The following sub-sections detail the findings from the integration and benchmarking exercise from the previous section. We start at the dimensional level and then go deeper into the aspects. Finally, we discuss the CIMMs, the implications of the findings, our recommendations for implementation and the limitations of the study.

4.1. Dimensions level

An evident gap in the results is that, as with any strategy (Rumelt, 2012, 2022), the underlying reason for the CI efforts should be the starting consideration. However, despite the need for CI practitioners to start with the end in mind, the CI Purpose dimension is the second least addressed in identified CIMMs.

A second finding is that only five CIMMs include the CI Purview dimension and aspects. The scope is critical for the CI practice as it defines the focus and conditions the effectiveness of the activities. It is impossible to develop intelligence for the entire CI scope. In an information-overloaded world, CI professionals must trade off the amount of Big Data (Laney, 2001) processed vis-à-vis the (lack of) computing power and the available headspace. The considerable stream of research on Key Intelligence Topics (KITs) is proof of the importance and guidance on this topic (J. Herring, 2008; J. P. Herring & Leavitt, 2011).

Surprisingly, all CIMMs address CI Practices despite being the least mentioned dimension in the 816 definitions used in developing the benchmarked definition (Madureira et al., 2021a). The importance of the CI Practices for the CIMM is evident since it materialises the concept. The Practices and Process dimensions form the core of the CI model, reinforcing each other in implementing CI effectively. The CI function location in the organisational structure (Calof, 1998; Comai & Prescott, 2007; J. P. Herring & Leavitt, 2011; Marceau & Sawka, 1999; Singh et al., 2008), the policies (namely the importance of respecting the legal and ethical aspects (J. P. Herring & Leavitt, 2011; Prescott, 1999), the capabilities of the organisation and the individual (Alvares et al., 2020; Comai & Prescott, 2007; Oubrich et al., 2018), the mindsets (APQC et al., 2004; Calof, 1998; Comai & Prescott, 2007; West, 2001), and the culture of intelligence (Alvares et al., 2020; Hedin et al., 2014; M-Brain et al., 2019; Oubrich et al., 2018), are the most appointed key success factors in the CIMMs for the development and evolution of CI (Adamala & Cidrin, 2011; Nasri & Zarai, 2013; M-Brain et al., 2019; Marceau & Sawka, 1999).

There is no surprise, though, in the complete alignment between the CIMMs and the CI Process dimension, given that it provides the blueprint for the CI activities performed and overall output.

The lower level of alignment (85,7%) towards the CI Product dimension is somehow more problematic given the importance the quality of CI has on decision-making, which in turn profoundly impacts the performance of organisations.

4.2. Aspects level

An in-depth analysis of the aspects (and sub-aspects) evidence a high synonymy, polysemy, and homonymy. Navigating the meaning of the aspects across CIMMs is extremely difficult given its number, the diverse nomenclature used, and the longitudinal evolution of the CI construct (Prescott, 1999). It is almost impossible to benchmark the maturity level between CI functions, programs, organisations, industries or countries using different CIMMs. Therefore, there is a clear need for a unified reference model with standardised nomenclature of dimensions and aspects.

Another important finding is the different levels of the thoroughness of the CIMMs regarding the aspects. On average, for any given dimension, the CIMMs do not address half of the aspects of the unified view of CI. Again, this reinforces the need for a holistic go-to CIMM with a solid scientific base that executives and academics can rely upon in theory and praxis.

4.3. CIMMs

A significant finding is that only one CIMM covers the 5Ps. This insight highlights the relevance of this study, addressing the research gap for a go-to CIMM of reference

and delivering on the expected contributions. Moreover, by benchmarking the best of theoretical and empirical CIMM knowledge vis-a-vis a unified and scientifically validated definition of CI (Madureira et al., 2021a, 2021b), we bring a solid foundation and scientific rigour to the CI practice, the broad-spectrum CI audiences, and the related disciplines. The findings also contribute to establishing CI science, as an integrated scientifically developed UCIMM will make the practice more scientific, repeatable, and comparable between organisations and industries. On top, none of the literature from the included CIMMs refers to the order of implementation of the 5Ps. Nor are the criteria for dimension selection, exceptions for best practices, or findings from case studies and empirical surveys. The level of arbitrariness can be considerable and dependent on the scope – specific country, industry, or organisation under analysis.

Overall, the findings highlight the essential contributions of the study. Firstly, all the dimensions and aspects included in the CIMMs fit within the CI unified view and modular definition (Madureira et al., 2021a). Nevertheless, there are still descriptors of the CI definition not addressed by aspects in any of the maturity models studied. Consequently, integrating the missing aspects into a CIMM will guarantee that professionals do not oversee any critical aspect and a sound grounding in CI theory. Secondly, there is the need for a more manageable CIMM. Assessing more than five dimensions can be burdensome for practitioners in a more pragmatic business setting. Conveying the results to the top management is also made more difficult as the number of dimensions increases. This miscommunication with top management can endanger the allocation of further needed resources for CI, endangering its development. As such, the hierarchical structuring of all the aspects into five dimensions seems to be a valuable empirical and theoretical contribution. Therefore, given previous CIMM shortcomings, we propose a unified CIMM in the next section.

4.4. Integration of CIMMs into a proposed UCIM

We used the Capability Maturity Model Integration (CMMI) developed by the Software Engineering Institute at Carnegie Mellon University to integrate the CIMMs (ISACA, 2022). This process and behavioural model, designed to improve the performance of organisations, share the exact purpose of CI (Madureira et al., 2021b), hence our preferred choice. The model aims to combine multiple business maturity models into one framework, thus additionally addressing the challenge identified in Section 4-3. A model is a tool for streamlining process improvement by developing measurable benchmarks and creating a structure for encouraging productive, efficient behaviour throughout the organisation, functions, and projects. Therefore, it leverages the established standards for vetting vendors and suppliers, identifying and resolving process issues, and minimising risk while building a corporate culture that supports the new integrated model. In addition, the maturity and capability levels of an organisation provide a way to characterise its capability and performance.

4.4.1. Maturity Levels (ML)

MLs represent a staged path for the organisation to improve the performance and processes efforts based on predefined dimensions and aspects. Within each ML, the dimensions and aspects also provide a path to performance improvement. Each ML increments the previous by adding new functionality or increased rigour. The goal is to raise the maturity of the organisation to the highest ML. Once reached, organisations should focus on maintenance and regular improvements, a learning organisation.

The journey starts at ML0 – *Incomplete* – where CI work may or may not get completed. CI goals are not established, and the processes are partly formed or do not meet the needs of the organisation. In ML1 – *Initial* – CI processes are viewed as unpredictable and reactive. CI work gets completed, but it is often delayed or over budget. This is the worst level for an organisation facing an unpredictable environment that increases risk and inefficiency. In ML2 – *Managed* –

organisations achieve the project management level. Projects are planned, executed, measured, and assessed, but many issues remain unaddressed. In ML3 – *Defined* – organisations are more proactive than reactive. A set of organisational policies and standards guide projects, programs, and portfolios. Organisations know their shortcomings, how to overcome them and the objectives for improvement. In ML4 – *Measured* – the organisation starts to measure and control the business, working off quantitative data to determine predictable processes aligned with stakeholder needs. The organisation manages risk with insight-driven process deficiencies. Lastly, in ML5 – *Optimised* – the organisation processes are stable, flexible, and agile. The learning organisation status is achieved with continuous improvement and responding to changes or other opportunities in an innovative and agile way. ML4 and ML5 are considered high maturity and stakeholder and customer-centric.

4.4.2. Capability Levels (CL)

CLs are used to evaluate the CI process improvement and performance of the organisation. They bring structure to the process and performance improvement. Each

CL builds on the last, in the same fashion as MLs, for appraising an organisation. The CLs range from CL0 – *Incomplete* – with inconsistent performance and incomplete approach to achieving the intent of CI. In CL1 – *Initial* - organisations address performance issues in specific activities, but there is not a complete CI practice in place. Cl2 – *Managed* – there is a complete set of procedures that result in CI practice improvement. Finally, in CL3 – *Defined* – the focus is on achieving project and organisational performance objectives with clear organisational standards for managing CI projects.

4.4.3. Dimensions and Aspects

Based on the finding from Section 4-3 that some aspects are present but do not thoroughly cover all the relevant descriptors from Madureira et al. (Madureira et al., 2021a), we focused on adding the missing aspects to the UCIMM. Furthermore, given that the 5Ps and their descriptors are empirically proven, the outcome is a hierarchical catalogue (cf. Figure 3) of mutually exclusive CI maturity dimensions covering all aspects replicating the benchmarked visual abstract (Madureira et al., 2021a).
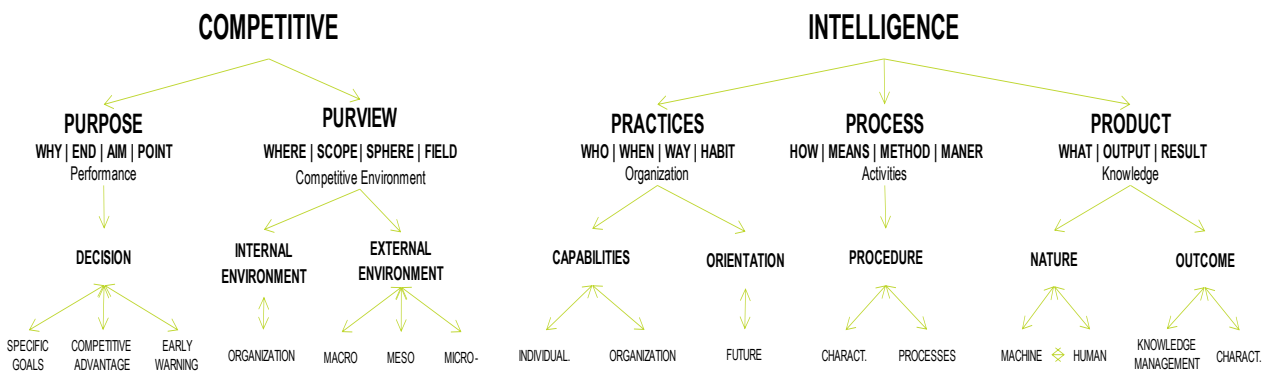
Figure 3. UCIMM hierarchical meta-model – dimensions, aspects, and sub-aspects (adapted by the authors)

4.4.4. The proposed UCIMM

The UCIMM proposed comprises five levels of maturity, three levels of capability, five dimensions, eight aspects, and sixteen sub-aspects. The UCIMM is multi-dimensional, hierarchical, staged, primarily qualitative and built on the integration of previous studies.

Table 4. The UCIMM (prepared by the authors building on Madureira et al. unified view of CI (Madureira et al., 2021a)

Name of the CIMM	CI Dimensions and (aspects)					Model Maturity Levels
	Purpose	**Purview**	**Practices**	**Process**	**Product**	
Unified Competitive Intelligence Maturity Model (UCIMM)	Performance Decision (specific goals, competitive advantage, early warning)	Competitive environment External (macro, meso, micro) Internal (org. functions)	Org. practices Capabilities (individual, organisational, structure, policies, mindset, culture) Orientation (time horizon)	Activities Procedure (processes, characteristics)	Knowledge Nature (augmented, machine, human) Outcome (knowledge management, characteristics)	**Proposed Maturity Levels** 0. Incomplete 1. Initial 2. Managed 3. Defined 4. Measured 5. Optimised

Following, we propose four integrated graphical visualisations (Figures 4-7) and their explanation to guide and help CI professionals implement the UCIMM in practice.

4.4.5. CI Purpose

CI aims to create value by addressing its stakeholder needs in a unique and superior way vis-a-vis its competitors. As such, organisations must continuously make decisions to adapt to the evolving context and stakeholder needs and wants. Stakeholder centricity is pivotal to guaranteeing that the value created is superior to the value provided by competitor organisations at any time. Optimised CI organisations support specific strategic, tactical, and operational decisions, help develop competitive advantages and provide early warning to decision-makers. Thus, the critical constructs are adaptation, agility, and anticipation.
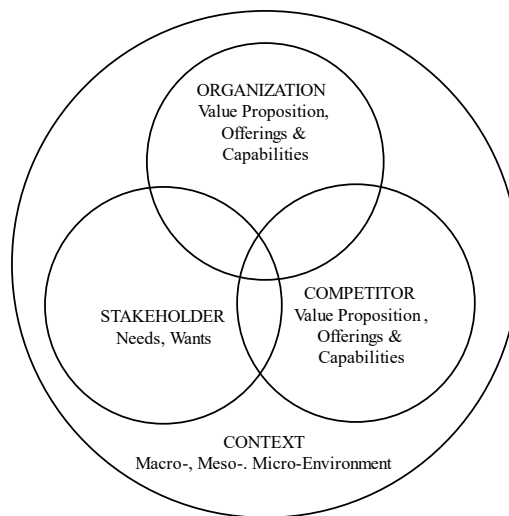
Figure 4. CI Purpose (developed by the authors)

4.4.6. CI Purview

The scope of CI is the entire competitive environment (Figure 5). It encompasses the macro forces (macro-environment – outer arrows), the market forces (meso-environment – dashed triangle), the industry forces (microenvironment – industry (Porter, 2008)), and the internal environment (inside the organisation – players).

Therefore, given its wide dimension, aligning the scope addressed by the CI function with the purpose of the organisation is paramount. Most notably matching the scope to the maturity level of the CI competencies. An eventual mismatch affects the quality of CI, leading to sub-standard decisions and ultimately jeopardising the overall performance. Therefore, the CI practice must start small and increase the scope as its resources and competencies develop.
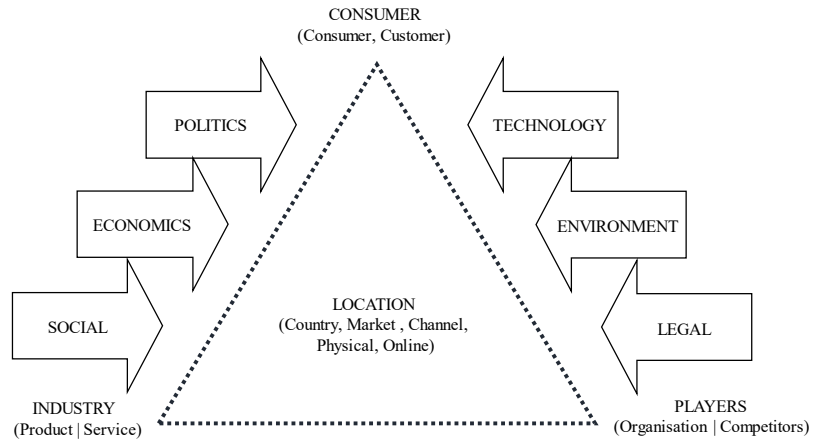
Figure 5. CI Purview (developed by the authors)

4.4.7. CI Practices and Process

The Core CI Model results from integrating the CI Practices and Process dimensions. Process-wise, learning organisations continuously adapt and improve their processes, tools, and techniques to support high-quality decision-making. The activities in the middle concentric circle (Figure 6) are guided by the CI procedure and executed with project management proficiency. The CI practice (and performed activities) depends on soft and hard factors: the place it occupies in the organisational structure, the policies that guide its execution, the mindsets, and the intelligence culture. The time orientation also impacts CI activities. Understanding the past is not enough; understanding the present may not be possible without considering the past, and anticipating the future is impossible without previous time horizons. Organisations optimising CI are forward-looking, integrating the different time horizons synergically to create a new official future (Wilkinson & Kupers, 2013). In a nutshell, CI needs to be an established support activity within the value chain of the organisation.
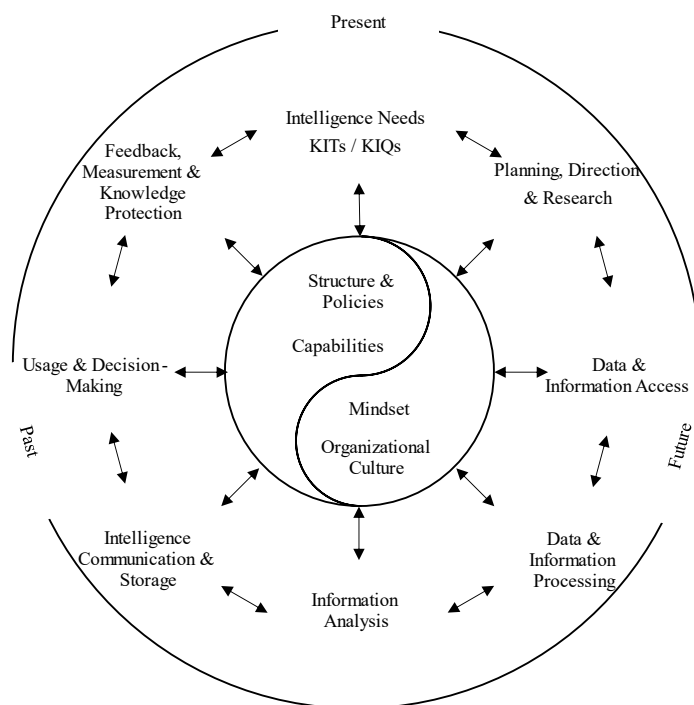
Figure 6. Core CI Model: Practices and Process (developed by the authors)

4.4.8. CI Product

The output of CI outcome is a set of artefacts (deliverables, systems, or projects) produced for a given purpose, within a specific scope, through a systematic process, and a defined set of practices. Given the need for anticipation, organisations must act on quality intelligence – meaning the actionable insights will be verified true (converted into knowledge) or allow for creating an official future (Wilkinson & Kupers, 2013). Despite knowledge being the desired output, if an organisation waits for the insights to be verified true (e.g., a merger between two competitors), it will lose its opportunity to influence the competitive outcome. As such, CI has no value if the decision-makers receive factual truths. They need actionable insights.

Moreover, the CI functions will derive learnings from using such intelligence and converting them into wisdom. The knowledge and wisdom of today are the data points of tomorrow, allowing CI practitioners to develop new higher-order intelligence. An increasingly important factor is the augmentation of artificial intelligence by CI professionals to guarantee reduced time to insight and overall timeliness of deliverables. Therefore, the CI function must not limit itself to data science or information management and should leverage knowledge management to become a learning organisation (Alvares et al., 2020).
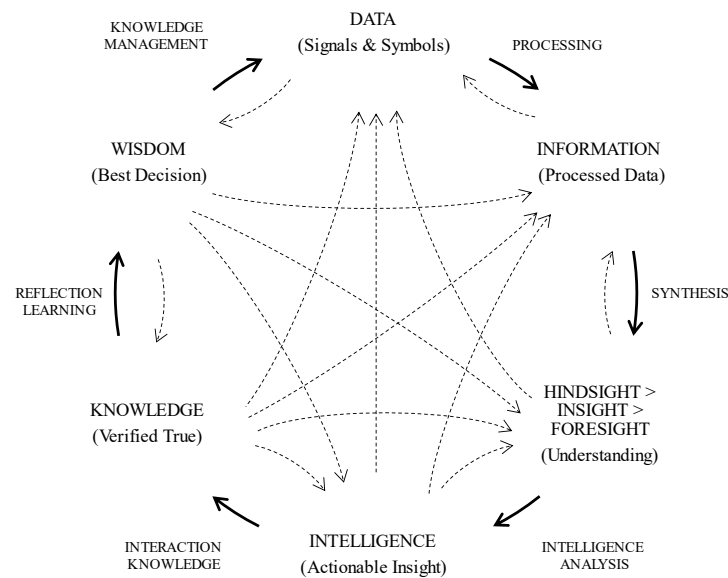
Figure 7. CI Product (developed by the authors)

4.5. Limitations and future research

We purposely limited the study to CIMMs and excluded models focusing on CI subdomains, such as Business Intelligence MMs, Artificial Intelligence MMs, or Capability MMs. The specific models can thus be integrated for a more thorough and granular assessment, guidelines, and evolutionary path. Namely, AIMMs can be a fruitful and valuable research avenue, given the need for guidance in this newer field within CI. Another research path is the empirical validation of the proposed model, the UCIMM. To this end, developing a scientifically validated scale would be essential.

5. CONCLUSION

The study successfully addressed the need to develop a UCIMM for effective practical guidance addressing the conflicting interests of academics, executives, practitioners, and vendors. This study adds to existing theory by synthesising the current CIMMs literature, serving as a future reference for all CI stakeholders. More prominently, it expands CI theory with the first ever integrated CIMM based on a scientific and empirically validated definition of CI. Furthermore, it contributes to practice by identifying gaps in existing CIMMs dimensions and aspects, providing a thorough and scientifically sound UCIMM. The model allows practitioners to pinpoint and address the areas they need to improve.

The accompanying frameworks support a better assessment, implementation, and development of the CI practice in organisations, navigating the adverse impacts of continuous change. Higher quality CI – timely, actionable, accurate, relevant (TAR) (Prescott, 1999) – should result in better decision-making and improved performance of organisations. On becoming a reference model, the UCIMM will save time while guiding the effectuation of CI construct and practice, functions, systems and programmes in surpassing the average and reaching the world-class optimised level of maturity.

6. DECLARATIONS

6.1. Author Contributions

Conceptualisation, LM, AP, and MC; methodology, LM; formal analysis, LM; investigation, LM; resources, LM; data curation, LM; writing—original draft preparation, LM; writing—review and editing, LM, AP, and MC; visualisation, LM; supervision, AP, and MC; project administration, LM, AP, and MC; funding acquisition, AP and MC. All authors have read and agreed to the published version of the manuscript.

6.2. Funding

6.3. Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors.

REFERENCES

ACI, & Gilad, B. (2022). *2022 CIP^TM Survey - A Changing Role Bodes Well* (p. 16) [Survey]. Academy of Competitive Intelligence.

Adamala, S., & Cidrin, L. (2011). Key Success Factors in Business Intelligence. *Journal of Intelligence Studies in Business*, *1*(1), 107–127. https://doi.org/10.37380/jisib.v1i1.19

Alvares, L. M. A. de R., Itaborahy, A. L. C., & Machado, R. P. M. (2020). Modelo de Maturidade em Inteligência Organizacional: uma visão integrada à gestão da informação, gestão do conhecimento e inteligência competitiva. *Informação & Sociedade: Estudos*, *30*(4), 1–21. https://doi.org/10.22478/ufpb.1809-4783.2020v30n4.57352

APQC, Hasanali, F., Leavitt, P., & Lemons, D. (2004). *Competitive Intelligence: A Guide for Your Journey to Best-Practice Processes*. Amer Productivity Center.

Bartes, F. (2014). Defining a Basis for the New Concept of Competitive Intelligence. *Acta Universitatis Agriculturae Et Silviculturae Mendelianae Brunensis*, *62*(6), 1233–1242. https://doi.org/10.11118/actaun201462061233

Bennett, N., & Lemoine, J. (2014). What a Difference a Word Makes: Understanding Threats to Performance in a VUCA World. *Business Horizons*, *57*, 311–317. https://doi.org/10.1016/j.bushor.2014.01.001

Breakspear, A. (2013). A New Definition of Intelligence. *Intelligence and National Security*, *28*(5), 678–693. https://doi.org/10.1080/02684527.2012.699285

Brocke, J., Simons, A., Niehaves, B., Niehaves, B., Reimer, K., Plattfaut, R., & Cleven, A. (2009). Reconstructing the Giant: On the Importance of Rigour in Documenting the Literature Search Process. *ECIS 2009 Proceedings*, *161*. https://aisel.aisnet.org/ecis2009/161/

Brody, R. (2008). Issues in Defining Competitive Intelligence: An Exploration. *IEEE Engineering Management Review*, *36*(3), 3–16. IEEE. https://doi.org/10.1109/emr.2008.4648884

Bruin, T. de, Freeze, R., Kulkarni, U., & Rosemann, M. (2005). Understanding the Main Phases of Developing a Maturity Assessment Model. *ACIS*

2005 Proceedings, *109*. https://aisel.aisnet.org/acis2005/109

Calof, J. (1998). Increasing your CIQ: the competitive intelligence edge. *Economic and Technology Development Journal of Canada*, *Art 22/98*, 103–108.

Calof, J., Sewdass, N., & Arcos, R. (2017). Competitive Intelligence: A 10-year Global Development. *Competitive Intelligence Magazine*, *20*(2), 21–26.

Comai, A., & Prescott, J. E. (2007). *Workbook: World-Class Competitive Intelligence Function* (E. Ediciones, Ed.; 1st ed.). Emecom Ediciones.

Cooper, H. M. (1988). Organising Knowledge Syntheses: A Taxonomy of Literature Reviews. *Knowledge in Society*, *1*(1), 104–126. https://doi.org/10.1007/BF03177550

Crayon, & SCIP. (2022). *2022 State of Competitive Intelligence* (State of Competitive Intelligence, p. 44) [Survey]. Crayon.

Duncan, R. W., & Weiss, A. (1979). Organisational Learning: Implications for Organisational Design. *Research in Organisational Behaviour: An Annual Series of Analytical Essays and Critical Reviews*, *1*, 75–123.

Eisenhardt, K. M. (1989). Making Fast Strategic Decisions in High-Velocity Environments. *Academy of Management Journal*, *32*(3), 543–576. https://doi.org/10.5465/256434

Fiedler, Fred. E. (1964). A Contingency Model of Leadership Effectiveness. In *Advances in Experimental Social Psychology* (Vol. 1, pp. 149–190). Elsevier. https://doi.org/10.1016/S0065-2601(08)60051-9

Fraser, P., Moultrie, J., & Gregory, M. (2002). The Use of Maturity Models/Grids as a Tool in Assessing Product Development Capability. *2022 IEEE International Engineering Management Conference, 18-20 August*, *1*, 244–249 vol.1. https://doi.org/10.1109/IEMC.2002.1038431

Harkleroad, D. (1998). Ostriches and Eagles II. *Competitive Intelligence Review*, *9*(1), 13–19. https://doi.org/10.1002/(SICI)1520-6386(199801/03)9:1<13::AID-CIR4>3.0.CO;2-S

Hedin, H. (2005). *Competitive Intelligence in Large Companies – Global Study* (White Paper No. 4; Global Study, pp. 1–38). Global Intelligence Alliance.

Hedin, H., Hirvensalo, I., & Vaarnas, M. (2014). *The Handbook of Market Intelligence: Understand, Compete and Grow in Global Markets* (2nd ed.). John Wiley & Sons Ltd.

Heppes, D., & Du Toit, A. S. (2009). Level of Maturity of the Competitive Intelligence Function: Case Study of a Retail Bank in South Africa. *Aslib Journal of Information Management*, *61*(1), 48–66. https://doi.org/10.1108/00012530910932285

Herring, J. (2008). Defining Competitive Intelligence Needs: The Role of Key Intelligence Topics. In *Starting a Competitive Intelligence Function: A SCIP Best Practices Guide* (1st ed., Vol. 1, pp. 33–42). Competitive Intelligence Foundation.

Herring, J. P., & Leavitt, J. A. (2011). The Roadmap to a World-Class Competitive Intelligence Program. *Competitive Intelligence Magazine*, *14*(1), 9–28. SCIP.org.

ISACA. (2022). *CMMI Levels of Capability and Performance*. https://cmmiinstitute.com/learning/appraisals/levels

Kahaner, L. (1997). *Competitive Intelligence: How to Gather, Analyse, and Use Information to Move Your Business to the Top* (1st ed.). Simon & Schuster - Touchstone.

Klue, & SCIP. (2021). *The 2021 Competitive Enablement Report - What do Stakeholders Really Think About Your Competitive Programs* (p. 41) [Survey]. Klue + SCIP.

Lahrmann, G., & Marx, F. (2010). Systematisation of Maturity Model Extensions. In R. Winter, J. L. Zhao, & S. Aier (Eds.), *DESRIST 2010* (Vol. 6105, pp. 522–525). Springer. https://doi.org/10.1007/978-3-642-13335-0_36

Laney, D. (2001). 3D Data Management: Controlling Data Volume, Velocity, and Variety. *META Group Research Note*, *6*(70), 1–4.

Madureira, L., Popovic, A., & Castelli, M. (2021a). Competitive intelligence: a unified view and modular definition. *Technological Forecasting and Social Change*, *173*(December 121086), 1–17. https://doi.org/10.1016/j.techfore.2021.121086

Madureira, L., Popovic, A., & Castelli, M. (2021b). Competitive intelligence empirical construct validation using expert in-depth interviews study. *2021 IEEE International Conference on Technology Management, Operations and Decisions*, 1–6.

https://doi.org/10.1109/ICTMOD52902.2021.9739422

Marceau, S., & Sawka, K. (1999). Developing a World-Class CI Program in Telecoms. *Competitive Intelligence Review*, *10*(4), 30–40. https://doi.org/10.1002/(SICI)1520-6386(199934)10:4<30::AID-CIR6>3.0.CO;2-H

Marcial, E. C. (2018). Initial Proposal of a General Theory of Competitive Intelligence [Proposta Inicial De Uma Teoria Geral Da Inteligência Competitiva]. *Ciência Da Informação*, *45*(3), 59–75. http://dx.doi.org/10.22478/ufpb.1981-0695.2018v13n1.39268

M-Brain, Drieman, J., & Makinen, S. (2019). *Global Intelligence Survey 2019* (p. 32) [Survey & White Paper]. M-Brain.

Nasri, W., & Zarai, M. (2013). Key Success Factors for Developing Competitive Intelligence in Organisation. *American Journal of Business and Management*, *2*(3), 239–244. https://doi.org/10.11634/216796061302397

Neuendorf, K. A. (2019). Content Analysis and Thematic Analysis. In P. Brough (Ed.), *Advanced Research Methods for Applied Psychology: Design, Analysis and Reporting* (1st ed., pp. 211–223). Routledge.

Oubrich, M., Hakmaoui, A., Bierwolf, R., & Haddani, M. (2018). Development of a Competitive Intelligence Maturity Model: Insights from Moroccan Companies. *Journal of Intelligence Studies in Business*, *8*(1), 25–36. https://doi.org/10.37380/jisib.v8i1.303

Oxford English Dictionary. (2022a). Maturity. In *Oxford English Dictionary* (Oxford Languages and Google). Oxford University Press. https://www.oed.com/

Oxford English Dictionary. (2022b). Model. In *Oxford English Dictionary* (Oxford Languages and Google). Oxford University Press.

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., … Moher, D. (2021). The PRISMA 2020 Statement: An Updated Guideline for Reporting Systematic Reviews. *Systematic Reviews*, *10*(1), 89. https://doi.org/10.1186/s13643-021-01626-4

Page, M. J., Moher, D., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L.,

Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., … McKenzie, J. E. (2021). PRISMA 2020 Explanation and Elaboration: Updated Guidance and Exemplars for Reporting Systematic Reviews. *BMJ*, *372*(160), 1–36. https://doi.org/10.1136/bmj.n160

Pellissier, R., & Nenzhelele, T. E. (2013). Towards a Universal Definition of Competitive Intelligence. *South African Journal of Information Management*, *15*(2), 1–7. https://doi.org/10.4102/sajim.v15i2.559

Porter, M. E. (2008). The Five Competitive Forces That Shape Strategy. *Harvard Business Review*, *86*(1), 25–40.

Prescott, J. E. (1999). The Evolution of Competitive Intelligence - Designing a Process for Action. *Proposal Management (Journal of the Association of Proposal Management Professionals)*, *Spring*, 37–52.

Rumelt, R. P. (2012). *Good Strategy/Bad Strategy: The Difference and Why It Matters* (799615; 1st ed.). Crown Business.

Rumelt, R. P. (2022, June 23). Build a Strategy that Addresses Your Gnarliest Challenges. *Harvard Business Review*. https://hbr.org/2022/06/build-a-strategy-that-addresses-your-gnarliest-challenges

Senge, P. M. (2006). *The Fifth Discipline: The Art & Practice of The Learning Organisation* (Revised and Updated). Doubleday.

Singh, A., Fuld, L., & Beurgschens, A. (2008). A Roadmap for Ensuring Success. In *Starting a Competitive Intelligence Function* (pp. 263–276). Competitive Intelligence Foundation; SCIP.org. scip.org/cifoundation/

Taleb, N. N. (2007). *The Black Swan: The Impact of the Highly Improbable* (Vol. 2). Random House, Inc.

Vedder, R. G., & Guynes, C. S. (2001). A Study of Competitive Intelligence Practices in Organisations. *Journal of Computer Information Systems*, *41*(2), 36–39. https://doi.org/10.1080/08874417.2002.11646989

Vroom, V. H., & Yetton, P. W. (1973). *Leadership and Decision-Making* (1st ed.). University of Pittsburgh Press.

Webster, J., & Watson, R. T. (2002). Analysing the

Past to Prepare for the Future: Writing a Literature Review. *MIS Quarterly*, *26*(2.3), xiii–xxiii. https://misq.umn.edu/misq/downloads/download/editorial/176/

West, C. (2001). *Competitive Intelligence* (1st ed.). Springer.

Wilkinson, A., & Kupers, R. (2013). Living in the Futures - How Scenario Planning Changed Corporate Strategy. *Harvard Business Review*, *May*, 2–11.

Yap, C. S., Cheng, B. L., Mohamad Hussain, N., & Ahmad, R. (2018). Innovativeness, Market Intelligence Practices, and Firm Performance of Small- and Medium-Sized Tour Operators.

Tourism & Hospitality Research, *18*(2), 143–151. https://doi.org/10.1177/1467358416636931

Yap, C. S., & Rashid, M. Z. A. (2011). Competitive Intelligence Practices and Firm Performance. *Libri: International Journal of Libraries & Information Services*, *61*(3), 175–189. https://doi.org/10.1515/libr.2011.015

Yap, C. S., Rashid, M. Z. A., & Sapuan, D. A. (2013). Strategic Uncertainty and Firm Performance: The Mediating Role of Competitive Intelligence Practices. *Journal of Information & Knowledge Management*, *12*(04), 1350028-1–14. https://doi.org/10.1142/S0219649213500287

ANNEXES

Annex 1: PRISMA Checklist

Table 3. PRISMA 2020 Checklist (Page, McKenzie, et al., 2021)
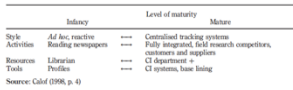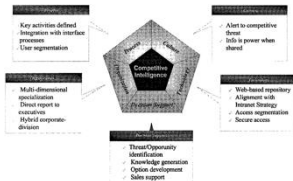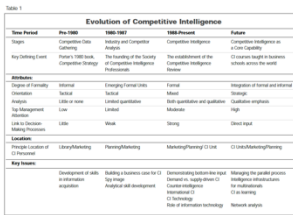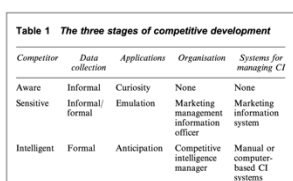
Section and Topic	Item #	Checklist item	Location where item is reported
Title			
Title	1	Identify the report as a systematic review.	**Page 1, line 1**
Abstract			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	**Page 1, lines 4-15**
Introduction			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	**Page 1-2, lines 45-13**
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	**Page 2, lines 14-23**
Methods			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	**Page 2, line 32 - Table 1**
Information sources	6	Specify all databases, registers, websites, organizations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	**Page 2, line 32 - Table 1**
Search strategy	7	Present the full search strategies for all databases, registers, and websites, including any filters and limits used.	**Page 2, line 32 - Table 1**
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and, if applicable, details of automation tools used in the process.	**Page 2, line 32 - Table 1**
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and, if applicable, details of automation tools used in the process.	**Page 2, line 32 - Table 1**
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g., for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	Page 5, line 6 - Table 2
	10b	List and define all other variables for which data were sought (e.g., participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	Page 5, line 6 - Table 2

Section and Topic	Item #	Checklist item	Location where item is reported
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	Page 2, line 32 - Table 1
Effect measures	12	Specify for each outcome the effect measure(s) (e.g., risk ratio, mean difference) used in the synthesis or presentation of results.	Page 6, line 27 - Table 3
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g., tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	Pages 6, lines 2-26
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	Page 6, lines 2-7
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	Page 6, lines 8-10
	13d	Describe any methods used to synthesise results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	Page 6, lines 2-7
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g., subgroup analysis, meta-regression).	Not applicable
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesised results.	Not applicable
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	Not applicable
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	Page 6, lines 2-7
Results			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Page 4, lines 25-26 – Figure 2
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded and explain why they were excluded.	Page 4, lines 25-26 – Figure 2
Study characteristics	17	Cite each included study and present its characteristics.	Page 5, line 6 - Table 2
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	Page 6, line 27 - Table 3
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimates and its precision (e.g., confidence/credible interval), ideally using structured tables or plots.	Page 6, line 27 - Table 3
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	Page 6, lines 10-26
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g., confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	Page 6, line 27 - Table 3
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	Not applicable
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesised results.	Not applicable
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	Not applicable
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	Page 6, lines 10-26
Discussion			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	Pages 8, lines 3-6
	3b	Discuss any limitations of the evidence included in the review.	Pages 8, lines 7-16
	23c	Discuss any limitations of the review processes used.	Page 6, lines 10-26; Page 13, lines 13-19
	23d	Discuss implications of the results for practice, policy, and future research.	Pages 8-13, lines 8-10
Other information			

Section and Topic	Item #	Checklist item	Location where item is reported
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	Not registered
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	Not prepared
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	Not Applicable
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	Page 19, lines 9-14
Competing interests	26	Declare any competing interests of review authors.	Page 14, lines 15-19
Availability of data, code, and other materials	27	Report which of the following are publicly available and where they can be found template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	Pages 14-17, lines 21-24

Annex 2: CIMMs Further Detailed Characterisation

Table 4. Visualisation and Description of included CIMMs (developed by the authors)

Citation	CIMM Name	Visualisation	Description
(Calof, 1998)	Competitive Intelligence Quotient (CIQ)		CI is about skills development, process, and structural and cultural change. The CIQ is the maturity level resulting from advancing style, activities, resources, and tools from infancy to maturity/World Class CI (WCCI). Building a competitive organisation requires its leaders' clear commitment and involvement, usually taking at least five years of committed effort from senior management to create a WCCI capability. A CI competencies list (from SCIP) is offered to support the development of the practice.
(Marceau & Sawka, 1999)	World-Class CI Program in Telecoms (WCCIP-T)		The model presents five development planes as prerequisites and critical success factors to achieving a world-class CI: corporate culture (conducive to information sharing); straightforward interface (relationship and location of the CI within the organisation); relevance and extent of the CI portfolio of services; decision-making support (throughout the company); technical infrastructure (aggregation, organisation, and diffusion CI). The audience is the Telecom industry-leading global players, and critical stakeholders were the object of an interviews study for the development of the model.
(Prescott, 1999)	Action-Oriented CI Program (AOCIP)		This model is based on the analysis of the evolution of CI to identify its key dimensions and levels. The dimensions and aspects (ten) are based on identified main attributes and the Key Decision Areas from the Decision-Oriented Approach to Designing a CI Program. The latter is based on the 1997 study on CI best practices from APQC. The main objective is to improve the effectiveness of CI while presenting a business case for proposal management professionals. The model adds additional value by identifying key defining events and issues in the evolution of CI.
(West, 2001)	CI Stages of Development (CISoD)		The model assumes that organisations move through three stages of CI evolution across four dimensions: Data Collection, Applications, Organisation, and CI Systems. The model has three levels. First, Competitor Awareness - key competitors are known, some knowledge exists, the organisation rarely uses data for decision-making, and there is no CI Systems in place). Second, Competitor-sensitive - aware of competitive threats, relies exclusively on informal information flows, and there is still no structured intelligence program. Third, Competitor-intelligent - organisation anticipate competitive actions and events, dedicates serious resources, and has a specific location with the structure and systems to support the CI function. The model aims to understand the drivers and support the development of CI in Europe. The book offers further insight into the probability of using CI depending on the need for development capability and the ability to use it in practice.

Citation	CIMM Name	Visualisation	Description
(APQC et al., 2004)	FIICH Model (FIICH)		The development of a CI program (CIP) proceeds through four stages: prestart-up, start-up, established, and world-class. Each stage of development has an identifiable set of critical activities or indicators that allows a company to know its level and transition activities to the next stage of the CI program development. The model is based on the premise that CIPs can be characterised by their stage of development and that identified external and internal factors may cause reversals to earlier stages — if not the failure of the CIP – must be examined. The model offers a methodology to evolve across dimensions into more advanced stages: Focus (clear set of goals and objectives); Implement (organisational culture); Institutionalise (incorporate CI practices); Change (modify processes, behaviours, and performance); Hone (dynamic, evolving, continuously improving activity). This empirical study provides a comprehensive understanding of what it takes to have a successful CI functional unit. Based on years of research of leading-edge organisations – supported by examples of best practices and tips from actual practitioners — it intends to guide readers in their own CI efforts. The study also aims to influence the academic community in researching the role of an intelligence function in decision-making theory.
(J. P. Herring & Leavitt, 2011)	CI Maturity Matrix (CIMMx)		The matrix is based on a six-month study of the core of the entire value chain processes to optimise the CI of the enterprise. A later benchmark in best practices determined that it was ineffective to continue to be 'everything to all people.' Consequently, the group re-assessed its ion and audience and focused primarily on providing CI to support enterprise-wide strategic decisions and research new market potential. As a result, the author developed the CI Maturity Matrix in early 2006 to serve as a roadmap to achieve a CI process that provided more value to the enterprise. The matrix is five stages per five dimensions description of best practices to develop mature CI practices.
(Comai & Prescott, 2007)	World Class CI (WCCI)		The structure of the WCCI model identified nine dimensions subdivided into 48 aspects. The authors prepared a statement describing what the judges believe to be a world-class performance for each dimension and its accompanying aspects. The modes were defined so that their statements apply regardless of how the Cl function is organised in the Strategic Business Unit (SBU). The authors defined "world-class" not as "the best that currently exists" but as "the ultimate best that might be achieved". The nine dimensions are: 1) Strategic Significance (recognised importance of Cl defining the scope and level of Cl activities); 2) CI in the Organisational Structure (clear operational vision between CI & the SBU); 3) CI Culture (organisational culture allows CI contribution to be maximised); 4) & 5) People and Physical resources (necessary for CI effective functioning); 6) CI Process (clearly defined and well established for gathering, validating, analysing, and storing CI); 7) CI project management (systems in place for selecting and prioritising CI projects); 8) Management Control (clear processes in place for top-level management control of Cl operations); 9) Evolution Of The CI Unit (clearly defined evolutionary strategy for how the Cl vision is to be achieved). The measurement scale to identify the development level is 1) We have not started this yet. 2) We have made some progress but still have a long way to go; 3) We have achieved a lot but still have a lot to do. 4) We have nearly achieved this but still have some work to do; 5) We have fully achieved this. The study aims to answer four research questions: What are the dimensions? What are the main dimensions? What are the milestones and relationships between them? What are the best ways to achieve WCCI?

Citation	CIMM Name	Visualisation	Description
(Singh et al., 2008)	Roadmap for Enduring CI Success (RECIS)		The RECIS results from the evolution of two reports and a study to ensure the success of CI activities in an organisation. The Self-Diagnostic Framework (SDF) (Singh & Beurgschens, 2006) provides value by describing the current stage of your program's development per attribute (dimension). The column with the most checks is where the organisation is in terms of CI development level (stage). This tool is a starting point to begin the analysis of the CI capabilities of an organisation by determining at which level it is and defining how it can be improved. The survey and white paper from Fuld & Singh (2007) explored the critical success factors of CI Programs (CIPs) across the globe. Using the exact eleven dimensions and "Four Intelligence Stages" from the SDF, it developed a more scientific and more profound assessment of the state of the CI discipline. A roadmap emerged from the two-year study where 141 worldwide companies examined and assessed their intelligence efforts (Fuld & Singh, 2007). Capability attributes are the key building blocks to developing a fully operational intelligence and competent CI function capability. The phases of development are the milestones for developing your function. The aim is to accelerate CI improvement as an individual, a team, or a function. NOTE: This study was based on a self-assessment test submitted via a web survey. Fuld & Company did not interview or audit each respondent after submitting the survey.
(Heppes & Du Toit, 2009)	CI Function Maturity Level (CIFML)		Heppes identified the typical evolution of a world-class CI capability typically as spanning three significant stages; 1) Early-stage (providing facts and creating CI awareness | less than 1,5 years of operation); 2) Mid-level capability (identifying trends and implications from gathered data, within an emerging partnership with CI users | operational between 1,5 - 3 years); 3) World-class (CI regarded as a key component of company strategy | more than three operating years). These stages evolve across seven dimensions: 1) CI Function (CIF) deliverables and capabilities; 2) analytical products; 3) Relationship with management; 4) staffing of CI function; 5) CI skills; 6) sources of information. The overall aim is to establish the level of maturity of the CI function. This study focused on identifying the maturity level of CI for a South African retail bank.
(J. P. Herring & Leavitt, 2011)	World-Class CI Program Roadmap (WCCIPR)		The roadmap shows where the CI Program (CIP) is now, the vision of where the organisation wants it to be, and the steps needed to get there. The roadmap organises a CIP in three-time stages: 1) developmental (first 1-2 years), 2) professionalisation (3-5 years), and 3) optimisation (6+ years). The Developmental Stage is critical to building a world-class professional program (WCCIP) from the onset. All dimensions must be identified and put in place over the first two years to develop a strong foundation. The Professionalisation Stage requires formidable effort to enhance the collection and analysis methods while advancing intelligence policies and procedures requires experienced intelligence expertise. Once these essential functions and processes are established, the next set of tasks is to professionalise those operations and the individuals who produce and apply the intelligence. The Optimisation Stage is the final stage in becoming a WCCIP. The real challenge is to maintain the level of organisational performance for years afterwards. The SCIP-IRI study found that the average age of world-class programs was about eight years. The vertical axis contains the four functional dimensions that form the core of all CI programs: 1) users and uses; 2) people and their professional development; 3) sources and methods; 4) the policies, processes, and procedures that bring the program altogether and ensure it runs smoothly. Following is a descriptive discussion of the twelve boxes on the Herring-Leavitt World-Class CI Program Roadmap. The choice of a roadmap framework for the WCCI model shows the evolution of the world-class process over time and, most significantly, promotes organisational learning.

Citation	CIMM Name	Visualisation	Description
(Hedin et al., 2014)	World Class MI Roadmap (WCMIR)		The World Class Market Intelligence Roadmap (WCMIR) incorporates intelligence development into an evolutionary process. The authors identified five levels of growth from the start to the world-class level and six key success factors (KSF) that move the program through those growth levels. The role of the CI manager is different for each of the five levels of the intelligence evolution roadmap. The same applies to all six Key Success Factors (KSF): the further the program advances through the various levels, the more sophisticated process it needs. Combining the six KSFs with the five stages creates a 30-box matrix. Each box describes a KSF relevant to each of the development steps. To grow the CI function, organisations need to implement the appropriate measures. Reviewing the development roadmap, one can identify the present status and what is necessary to move CI up a level. The roadmap can also help determine the CI function's future objectives. Over time, most CI functions should reach the intermediate level, where the basic intelligence processes are in place. However, several specific issues arise at that level and must be addressed before the organisation can move toward the advanced and world-class levels. The framework is based on research conducted during 2005- 2008 with 700 companies, and their input has been used to verify the roadmap concept. In addition, many companies have empirically tested the concept.
(Oubrich et al., 2018)	Competitive Intelligence Maturity Model (CIMM-M)		The maturity model proposed is based on a comprehensive review of recent literature. The objectives of this study are threefold: 1) determine the significant purposes of a CIMM, 2) identify the CI dimensions and levels of maturity, and 3) evaluate Moroccan CI practices. The conceptual framework articulates the CI dimensions and three maturity levels. The six CI dimensions are CI Culture; CI deliverables; CI sourcing; CI cycle; CI investment in resources; CI users; and CI application). Implementing these dimensions determines the position across three levels: early, mid, and world-class. The model was tested through an empirical study conducted in the Moroccan context. The results show that most Moroccan companies are in the early stage of CI, using environment scanning in a not-so-intense competitive environment allowing for the absence of a CI structure. However, most of these Moroccan companies are not able to cope with changes in the business environment as CI systems and processes are implemented on an irregular basis.
(M-Brain et al., 2019)	M-Brain - World-Class Intelligence Framework (WCIF)		M-Brain´s Intelligence Framework (M-BIF) expands the Hedin et al. WCMIR to help organisations achieve three benefits: better and faster decisions, time and cost savings, and organisational learning and new ideas. This is achieved by a systematic strategic market and competitive intelligence operation. Results are measured against and plotted on the matrix of nine Key Success Factors of an intelligence organisation (KSF) against five increasing levels of CI professionalism. The M-BIF framework distinguishes five maturity levels from Level 1 - beginners or "firefighters" - to the most advanced Level 5, the "futurists" and World Class intelligence organisations. The supporting survey gives the international CI community a good picture of the global average and world-class intelligence functions. In addition, the results offer in-depth information about the size of intelligence teams, their place within the organisation, available budget, number of stakeholders and contributors to intelligence (for co-creation) and much more. In concrete terms, the survey results are used by many companies to benchmark, set aspirational goals and develop roadmaps with implementation plans.
(Alvares et al., 2020)	Organisational Intelligence Maturity Model (OIMM)		The Organisational Intelligence Maturity Model (OIMM) presents the condition of dependence between information management (IM), knowledge management (KM), and CI to demonstrate that IM and KM are associated with the CI maturity level. The results from exploratory qualitative research based on a literature review show that IM is the foundation for KM, which, in its turn, supports and enables CI. This confirms that the maturity level as a series of one-dimensional linear stages is also applicable to the organisational intelligence expanded model. The result is a matrix of 2 categories and 17 dimensions across the three stages (IM, KM, and CI) and six

Citation	CIMM Name	Visualisation	Description
			levels (Non-Managed/Individual, Structuring/Group, Formative/Integration, Effective/Creation, Analytical/Network, and Proactive/Full). The study aims to explain business development relative to the progression from IM to KM and CI maturity levels to understand, implement, improve, benchmark or self-assess IM, KM, or CI models.